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(54) An impact protection device for vehicles

(57) The device has a bumper 10 extending transversely across the vehicle front and a lower lying substantially rigid protector part 11 arranged beneath the bumper 10 and extending forward in the manner of a spoiler. The protector part 11 extends across the vehicle and round the sides to adjacent the wheel arches. The protector 11 has a hard skin 15 with a solid foam interior incorporating reinforcements 12, 13, 16. The protector 11 is yieldable to move behind the front edge of the bumper 10 when greater than a predetermined force is applied thereto.

In other embodiments, at least the front part of the protector part is movable selectively into two positions; a basic position where the protector part projects beyond the bumper 10 and a retracted position behind the bumper where it is aligned with the face of the bumper.

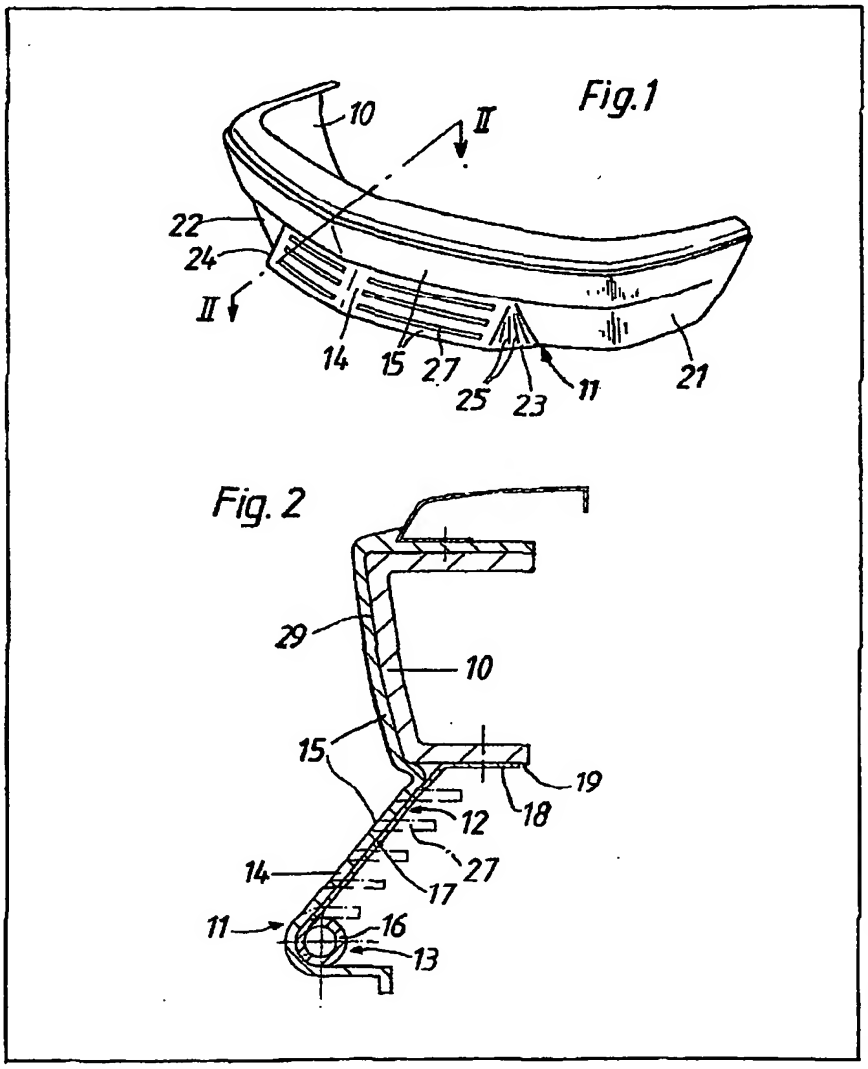

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Fig.1

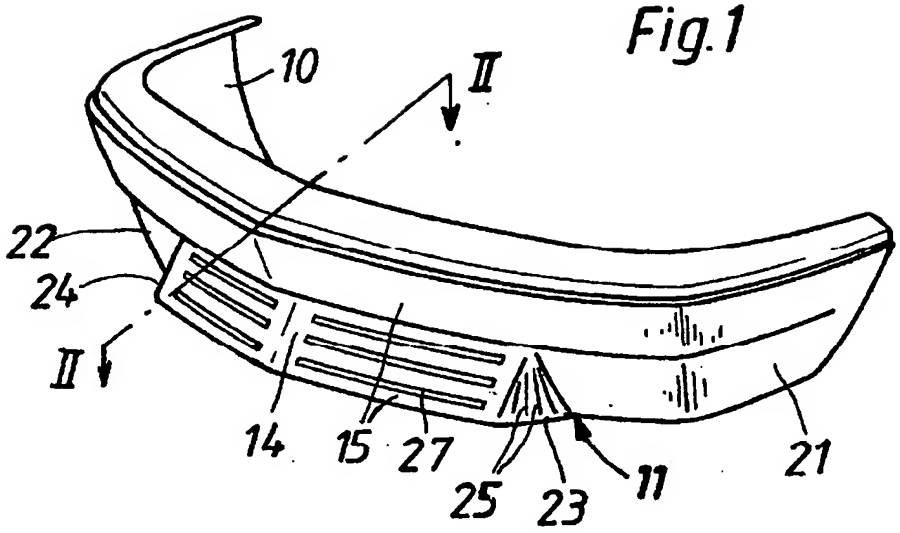


Fig. 2

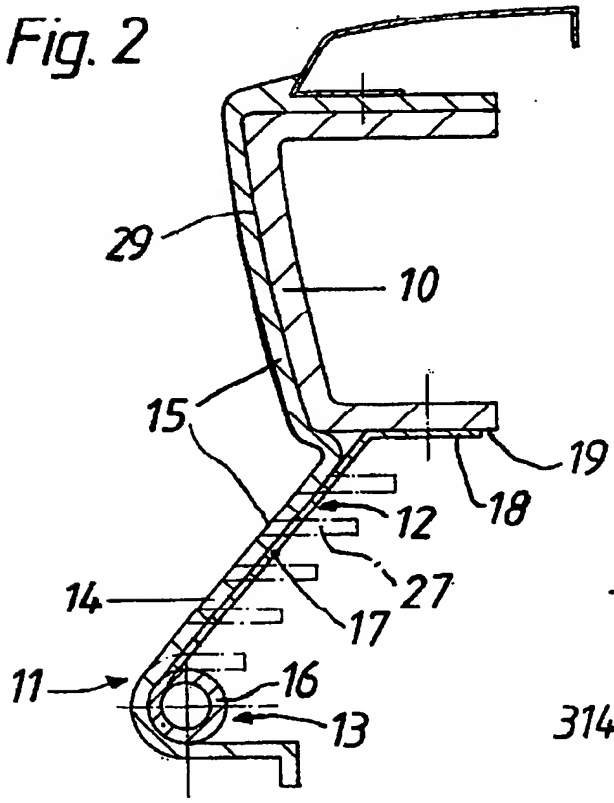


Fig.3

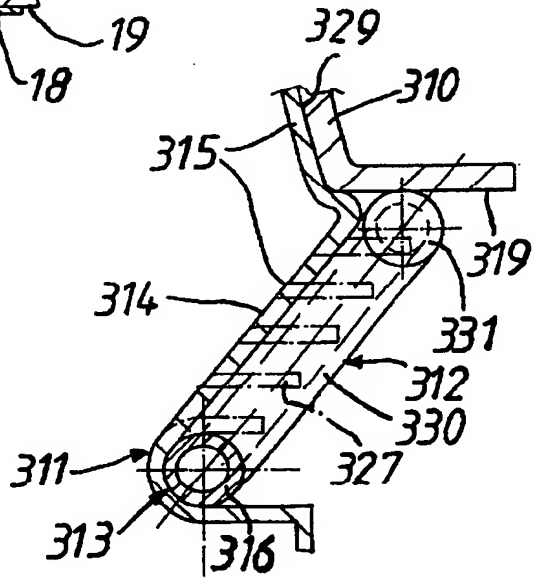


Fig.6

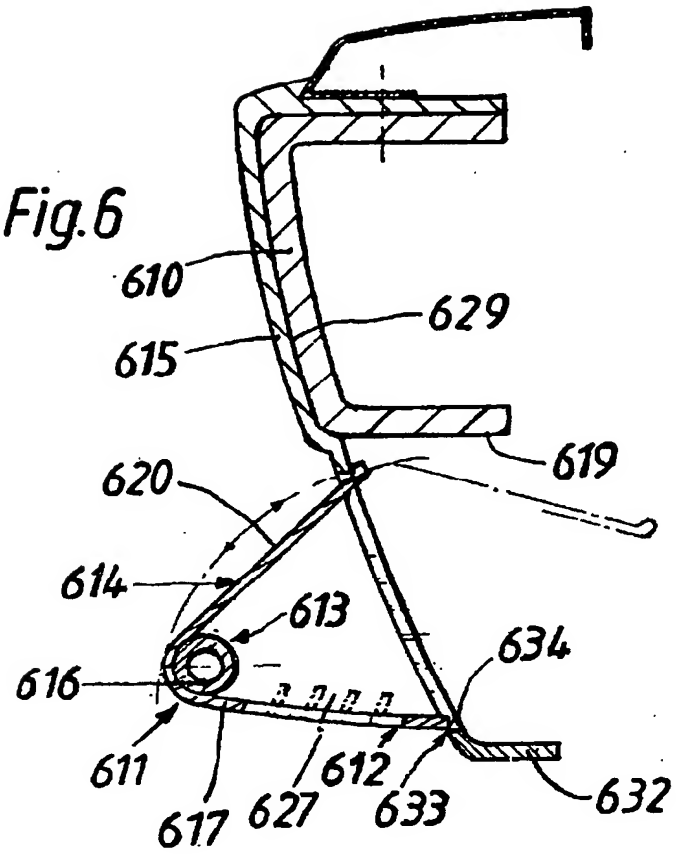


Fig.4

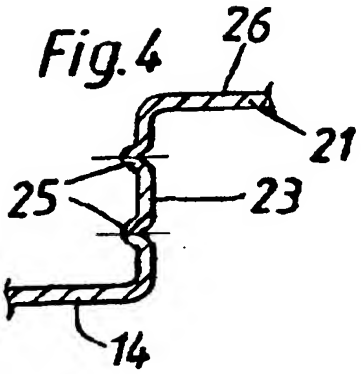


Fig.5

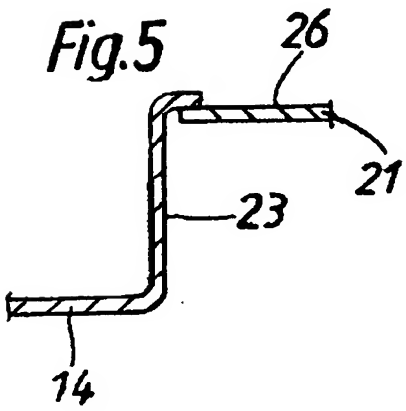
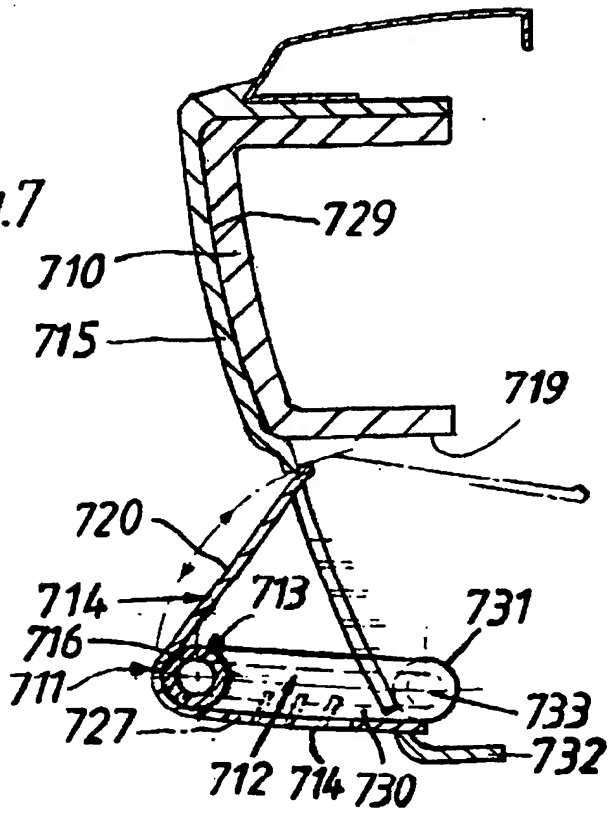


Fig.7



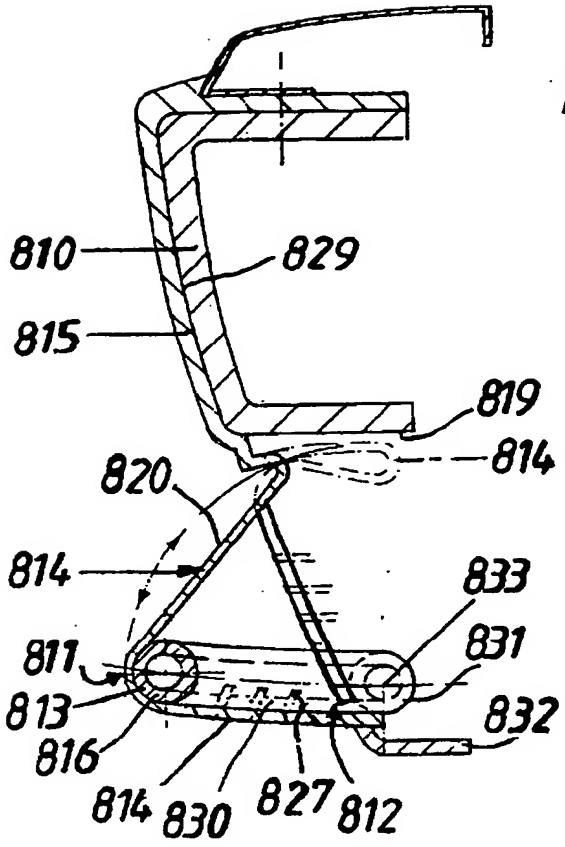


Fig.8

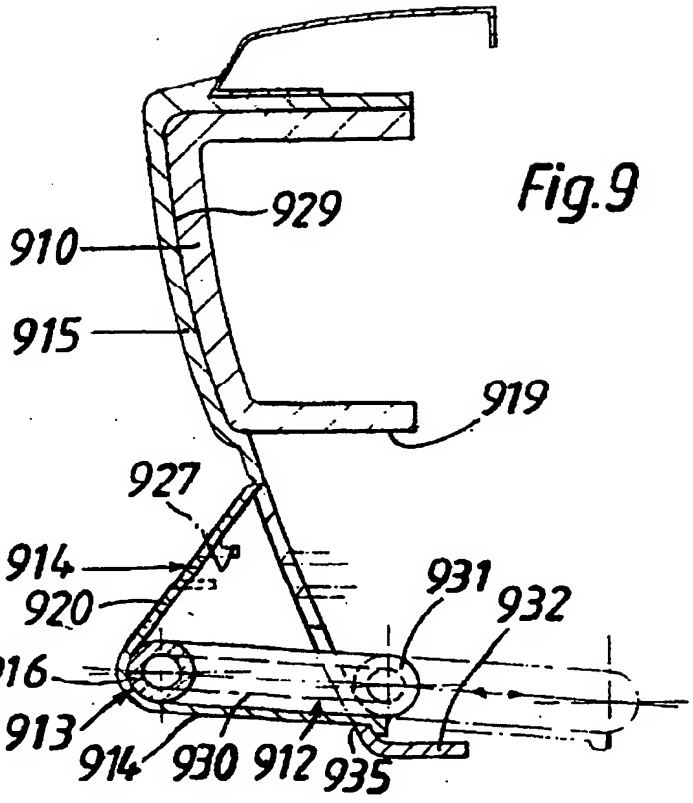


Fig.9

Fig. 10

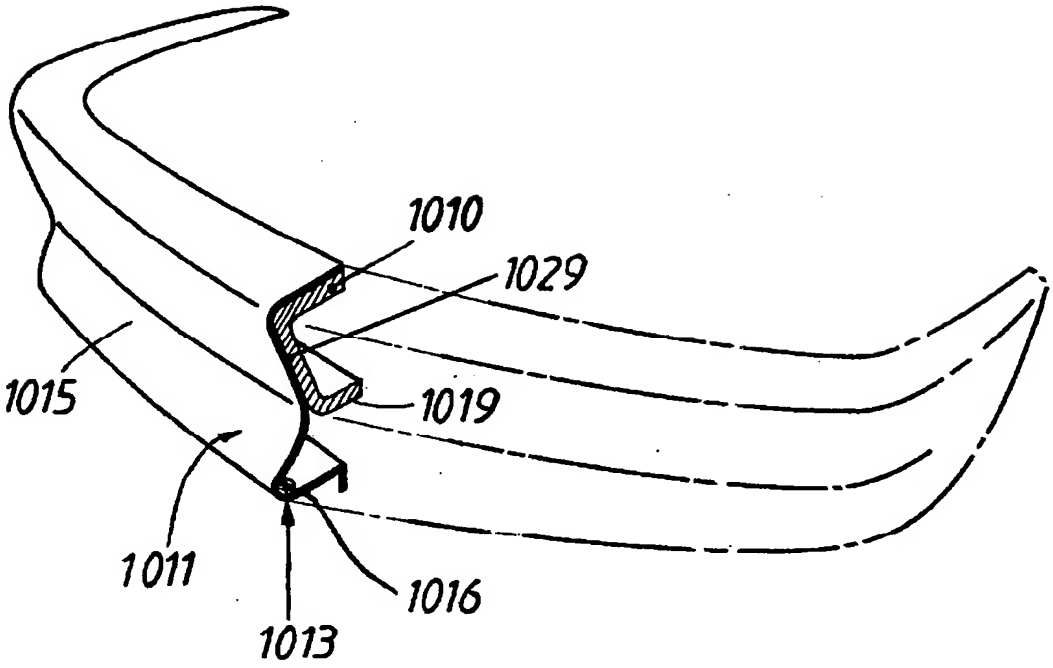


Fig. 11

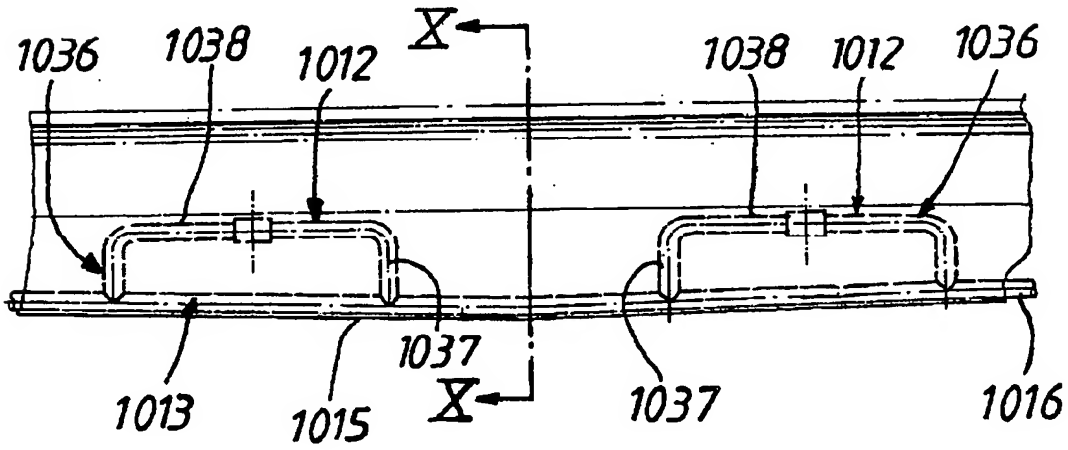


Fig.12

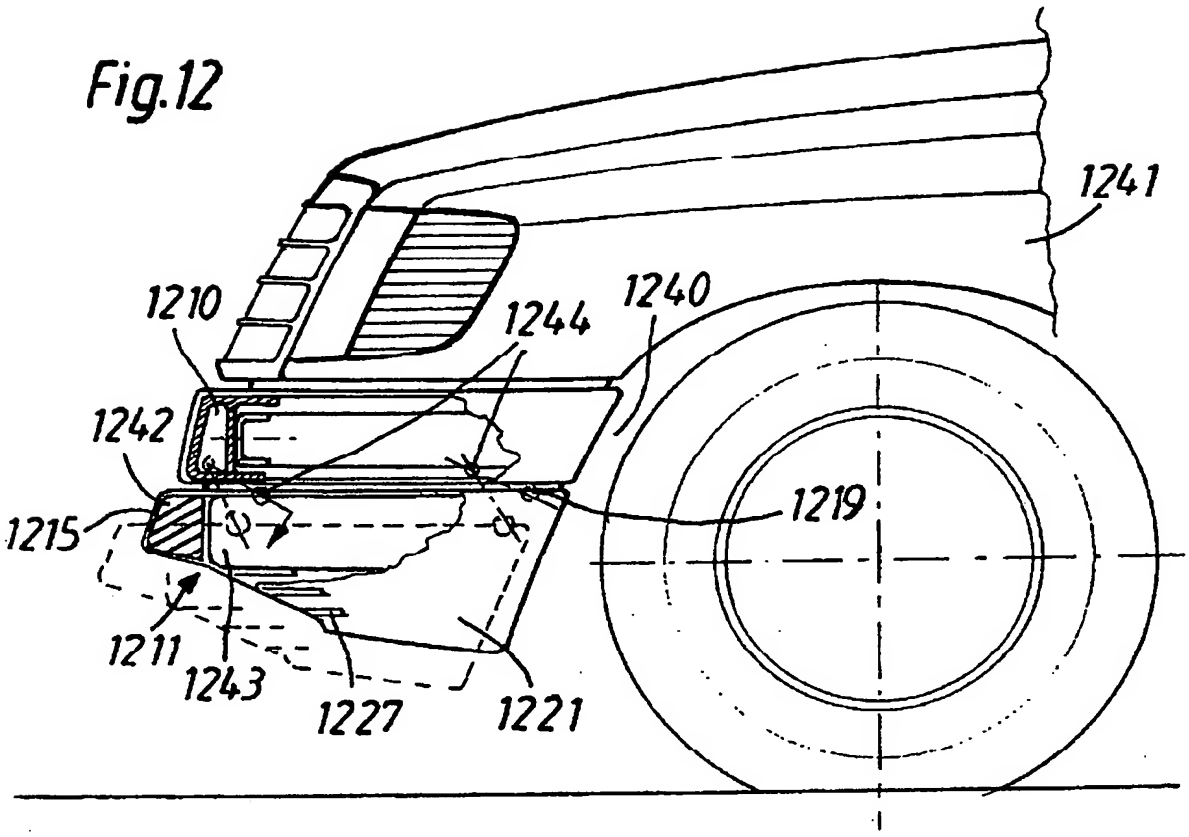
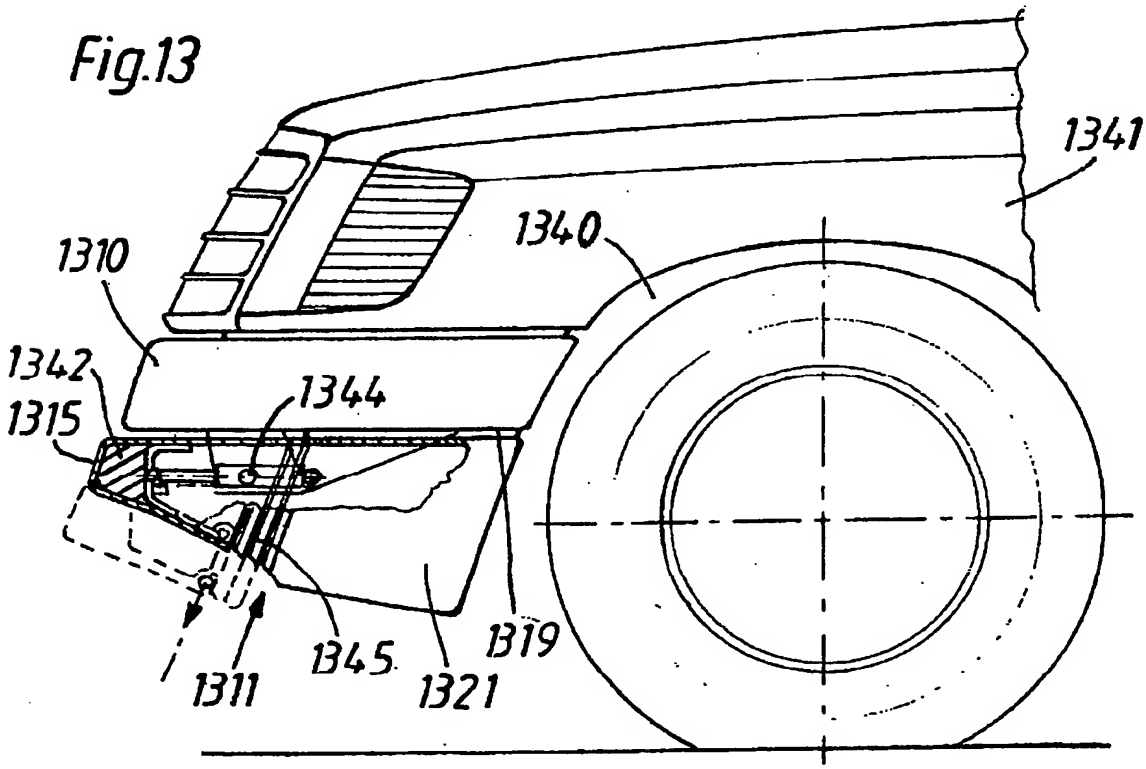


Fig.13



SPECIFICATION

Impact protection device for vehicles, particularly motor vehicles

The invention relates to an impact protection device for vehicles including a bumper arranged to extend, in the installed position transversely across the front of the vehicle with a forward projecting, substantially rigid pedestrian protector part below the bumper.

In a known impact protection device of this type, the pedestrian protector part is constructed as a padded cross girder which is arranged lower than the bumper and also in front of the latter. A pedestrian colliding with the vehicle is caught so low by this cross girder that he is not knocked down and then run over, but is tipped onto the relatively soft deformable vehicle nose, whereby the risk of injury, or at least the severity of injuries, is considerably reduced.

However, such a cross girder arranged in front of the vehicle nose is not only aesthetically unattractive — which deters many prospective clients from purchasing a motor car equipped with such an impact protection device — but seriously impairs the characteristics of the vehicle with regard to its aerodynamics and its stability, particularly at higher speeds. Furthermore, relatively large gaps exist between cross girder and bumper or vehicle nose, which increase the risk of injury to a pedestrian hit by the vehicle and may also have an unfavourable effect on the deformation characteristics of the front of the vehicle.

The underlying aim of the invention is to produce an impact protection device for vehicles, particularly motor vehicles, which is formally integrated in the nose design of the vehicle and thus has an attractive exterior which at least has no negative influence upon the aerodynamics and the stability of the vehicle, and which further improves the protection of pedestrians with regard to reducing the risk of injury.

According to the invention, there is provided an impact protection device for vehicles, including a bumper arranged to extend, in the installed position, transversely across the front of the vehicle with a forward-projecting, substantially rigid pedestrian protector part below the bumper, wherein the protector part extends downwards from the bumper, is inclined forwards at an acute angle to the vertical at least in a central region oriented substantially transversely to the vehicle longitudinal axis, and leads round sideways apron-fashion approximately to the wheel arch of the vehicle on both sides of the vehicle.

Both the stability and the aerodynamics of the vehicle are considerably improved by the construction according to the invention of the pedestrian protector part. The device fits harmoniously into the nose design of the vehicle and is not only inconspicuous there, but lends the vehicle an additional aesthetically appealing touch by its spoiler-like appearance. The device presents the colliding pedestrian with a plane, smooth and closed surface free from edges and gaps, which reaches down a long way and is drawn laterally round the sides of the vehicle nose. by this means not only a pedestrian struck frontally, but also one who is hit by the vehicle obliquely in front, is tipped onto the vehicle nose in a favourable manner for minimising injury. The uniform smooth surface of bumper and pedestrian protector part also minimising additional injury to the pedestrian.

The device may be adopted with equal advantage both in the case of substantially straight bumpers and of bumpers with a strong sweep-back, and permits an advantageous design configuration in both cases. the optical image of the device appeals to the car purchaser or the car owner and thus promotes his readiness to equip his car with such a device serving to protect the pedestrian. Thus an additional contribution to traffic safety is made.

In a particularly advantageous embodiment of the invention the protector part has at least in its central region, an outer layer with a rind-like characteristic, and has in its outermost projecting zone a stiffening means of limited yieldingness, which is longitudinally continuous at least in the central region. The outer layer of the pedestrian protector part with its non-elastic, but relatively hard character with soft contours, reduces the contact injuries which occur in a collision.

The protector part may also have at least one beam adapted to yield to a frontal force exceeding a prescribed maximum value, which supports the stiffening element and brace the outer layer. With this construction, the pedestrian protector part withstands the forces occurring upon the collision with a pedestrian without appreciable deformation, within a specific range of speed of the motor vehicle. This ensures firstly that the low catching of the pedestrian, and tipping of the pedestrian onto the vehicle nose is ensured. Only at higher forces, e.g., at over 10,000 N, at which the risk of leg fractures exists, does the pedestrian protector part yield back approximately to the front edge of the bumper, and in doing so dissipates a considerable fraction of the energy of collision. In this way breakages or leg fractures by excessive local loading can be prevented even in a relatively high range of speed (up to 60 Km/h). In this case of collisions at higher speeds, at which it is no longer possible to protect the pedestrian in any case, or in the case of high static pressures, the pedestrian protector part yields back to behind the bumper, so that the latter receives the collision forces or the static pressures, such as occur during parking or manoeuvring, in the known manner.

In a further advantageous embodiment of the invention at least the front part of the protector part is movable selectively into two positions, the protector part or its front piece in its basic position, projecting beyond the bumper in the longitudinal direction of the vehicle, and in its retracted position being behind the bumper. The aerodynamics and the stability of the vehicle at speeds which lie above the range of speed in which pedestrian protection is still possible, are

decisively improved by these measures. The transfer of the protector part from its basic position into its retracted position and *vice versa* may be controlled by sensors or by coupling to a "Tempomat" that is, an automatic vehicle speed regulation system whilst the movement may occur via rocker levers or Bowden cables.

Further embodiments of the invention with elaborations and further developments material to the invention are the subject of the remaining claims, not explicitly mentioned here, to which express reference is made here.

The invention will now be described hereinbelow by way of example with reference to embodiments shown in the accompanying drawing wherein:

Fig 1 shows a perspective view of an impact protection device for a motor vehicle,

Fig 2 shows a section made along the line II—II in Fig 1, shown schematically,

Fig 3 shows a detail of the same section as in Fig 2, in the case of an impact protection device according to a second embodiment,

Fig 4 shows a detail of a horizontal section of front piece, side wall part and side apron of a pedestrian protector part of the impact protection device according to Fig 1,

Fig 5 shows the same section as in Fig 4, in an impact protection device according to a third embodiment,

Fig 6—9 each show a cross-section of an impact protection device according to further embodiment, illustrated schematically,

Fig 10 shows a perspective view of a partly sectional impact protection device according to a further embodiment,

Fig 11 shows a bottom plan of the impact protection device according to Fig 10,

Fig 12, 13 each show a side elevation of an impact protection device according to two further embodiments, partly, sectioned.

The impact protection device for vehicles, particularly motor vehicles, to be seen in a perspective view in Fig 1 and in section in Fig 2, includes a bumper 10, also known as a bumper bar, arranged to extend transversely in front of the vehicle front or vehicle nose, not shown, and a lower-lying substantially rigid pedestrian protector part 11 arranged beneath the bumper 10 and projecting forwards. The protector part 11 extends downwards from the bumper bottom edge 19. At least in a central region oriented substantially transversely to the vehicle longitudinal axis, the protector part 11 is inclined forwards at an acute angle to the vertical. The protector part 11 is extended sideways apron-fashion on both sides of the central region round to the sides of the vehicle approximately to the wheel arches, not shown, of the vehicle. In the embodiment according to Figs 1 and 2 the protector part 11 has a front piece 14 covering the central region of the vehicle front, which projects spoiler-fashion. The front piece 14 adjoined on each of the two sides by a side apron 21 or 22, which align substantially with the forward-facing front surface 29 of the bumper 10 and may be retained thereon.

The protector part 11 exhibits an outer layer 15 or outer shell with a rind or skin-like character, e.g., a relatively hard polyurethane skin. The layer of 15 covers at least the central region of the protector part 11, but covers the entire protector part in the present embodiment, and furthermore extends past the entire front surface 29 of the bumper 10. A stiffening element 13 of limited yieldingness, e.g., a stiffening element of plastic material, which is longitudinal continuous at least in the central region or in the front piece 14, is provided in the farthest projecting zone of the protector part 11. As is shown in Fig 2, the stiffening element 13 is constructed as a tubular cross strut, which may be e.g., a hollow profile tube of fibre-glass-reinforced plastic or a thin-walled metal tube. The protector part 11 also has a beam 12 which is constructed so that it becomes yielding in the event of a frontal force exceeding a prescribed maximum value, e.g., 10,000 N. This beam 12 supports the stiffening element 13 and braces the outer layer 15 of the protector part 11. The beam 12 is retained on the bumper 10. In the embodiment according to Figs 1 and 2 the beam 12 is constructed as a leaf-spring-like spring steel bracket 17 which is attached adjacent one edge 18 to the bumper 19 and supports the cross strut 16 on its free edge. The free edges of the spring steel bracket 17 has the same forward and downward inclination as the central region or the front piece 14 of the protector part 11. The outer layer 15 is arranged directly on the outward facing front side of the spring steel bracket 17. Air passage slots 27, which are indicated schematically in Fig 2, are provided in the outer layer 15 of the protector part 11 and/or in the spring steel bracket 18.

As is visible in Fig 1, the front piece 14 is connected to the two side aprons 21, 22 via side wall parts 23, 24. Fig 4 shows in detail a section through front piece 14, side wall part 23 and side apron 21. As this reveals, front piece 14, the side wall parts 23, 24 and the side aprons 21, 22 are mutually integral. The side wall parts 23, 24 has preshaped folds 25. As is clear from the embodiment in Fig 5, the side wall parts 23 and 24 may however also overlap the side aprons 21, 22 on their rear side 26 facing the vehicle. In this case it is possible for the front piece 14 to yield inwards between the two side aprons 21, 22 as far as the bumper front edge under the influence of forces, e.g., in excess of 10,000 N, so that these forces are now absorbed by the bumper 10 and the protector part 11 is not damaged. In the latter case only the front piece 14 and the side wall parts 23, 24 are mutually integral.

In the embodiment according to Figs 1 and 2 the longitudinally continuous cross strut 16 and the beam 12 constructed as a spring steel bracket 18 are provided only in the front piece 14 of the protector part 11. Likewise, the air passage slots 27 arranged to form an air inlet grille are to be found only in the front piece 14. It is however also possible to carry the beam 12 and likewise the

cross strut 16 into the side aprons 21 and 22.

If a pedestrian collides with a vehicle which is equipped with the above-described impact protection device, then he is received "softly" in the region of the leg, well below his centre of gravity, by the farthest projecting region of the protector part 11, in which the stiffening element 13 is present. By this means the pedestrian falls favourably and is, as it were, tipped onto the nose part of the motor vehicle. The collision with the smooth-surfaced long bonnet, which is largely yielding, is in any case less injurious to the pedestrian than if he is thrown by the vehicle onto the road, because here the speed differential is an additional factor. Even if the pedestrian strikes against the lateral nose part of the motor vehicle, the projecting and low-lying protector part prevents the pedestrian from being run over, because the pedestrian is deflected outwards by the protector part which is taken round the sides of the vehicle to the wheel arch. Contact injuries to the pedestrian are largely reduced by the "skin character" of the outer layer 14 of the protector part 11. The forces (up to a maximum value of approximately 10,000 N) which occur during a collision with a pedestrian are withstood by the protector part without appreciable deformation or without appreciable yielding. Such forces occur during a collision with a vehicle speed between 10 and 60 Km/h. Pedestrian protection is also only efficacious and purposeful in this range of speed. On the other hand, impact forces which occur in the case of a collision at higher speed, or static pressures such as may arise during parking and manoeuvring, cause the yielding protector part 11 (the front piece 14 in the embodiment according to Figs 1 and 2) to be slid back behind the front edge of the bumper 10. Thus, very high forces, or static pressures, are absorbed by the bumper 10 without destroying the protector part 11. The deeply down-drawn, forward-projecting protector part 11, which is taken round nearly to the front wheel arches of the vehicle on both sides, improves the aerodynamics of the vehicle and its stability.

The embodiment according to Fig 3 is largely identical with the embodiment according to Figs 1 and 2, except for a modified beam 312. The same components have therefore been provided with the same reference numerals, which are however increased by the number 300. The beam 312 and the tubular cross strut 316 are combined here to form an integral, substantially C-shaped stirrup 330. The two short arms of the stirrup 330 (only the one short arm 331 is visible in Fig 3) are attached to the bottom side 319 of the bumper 313 in the manner of a torsion bar. In the event of collision forces which exceed the state maximum value of e.g., 10,000 N, the stirrup 330 pivots, to the right in Fig 3, whilst the short arm 331 rigidly anchored at the bottom 319 twists about is fixed longitudinal axis. Similarly as in the embodiment according to Figs 1 and 2, the C-shaped stirrup 330 may be present only in the central region of the protector part 311. The external appearance of the impact protection device according to Fig 3 is then identical with that shown in Fig 1. Here again the outer skin 315 has front air slots 327 arranged grille-fashion, which may either extend across the entire protector part 311, or also be present only in a front piece 314 covering the central region of the protector part 311, as in the embodiment according to Figs 1 and 2.

In the embodiment according to Fig 6 components corresponding to the impact protection device according to Figs 1 and 2 are again designated by the same reference numerals, which are however increased by the number 600. In contrast to the embodiment according to Figs 1 and 2, the protector part 611, or at least its front piece 614, is made arbitrarily or automatically pivotable into two positions. In the basic position, the protector part 611 or its front piece 614 projects beyond the bumper 610 in the longitudinal direction of the vehicle, and in the so-called retracted position the protector part 611 or its front piece 614 recedes behind the bumper 610 and aligns approximately with the front surface 629 of the bumper 610. For this purpose the beam 612 is arranged pivotably about a pivot axis 633 oriented transversely to the longitudinal direction of the vehicle. The beam 612, which here again is constructed as a leaf-spring-like steel bracket 617, extends forwards in the basic position of the front piece 614 with a substantially horizontal, preferably slightly upwardly inclined, orientation. The two sides aprons 621 and 622 are mutually connected via a protector part strap 632 which leads through beneath the front piece 614. The spring steel bracket 617 is articulated by one end to the top edge of this protector part strap 632 and supports the cross strut 616 at its farthest projecting end. A shield 620, which may be integral either, as here, with the beam 612, or with the outer layer 615 of the protector part 611, is clamped between the bumper bottom 619 and the cross strut 616.

In the basic position of the protector part 611 shown in Fig 6, it is locked against pivoting. This locking is necessary so that in a collision with a pedestrian the protector part 611 cannot simply pivot, thus losing its protective efficacy for the pedestrian. On the other hand, when a specific speed, above 60 Km/h, is exceeded, at which pedestrian protection is in any case no longer conceivable and purposeful, the locking is released and the protector part 611 or the front piece 614 can hinge into the position on the bumper 610 indicated by dash lines in Fig 6. This substantially improves the aerodynamics of the impact protection device at higher speeds. The hinging of the protector part 611 or of the front piece 614 may be controlled by sensors or also by a "Tempomat", that is an automatic vehicle speed regulation system, whilst the tilting movement of the protector part 611 or of the front piece 614 may be effected via rocker levers or Bowden cables. The latter applies similarly to the variants of the impact protection devices according to Figs 7—9.

In the embodiment according to Fig 6 the leaf-spring-like spring steel bracket 617 is attached to the protector part strap 632 by means of a film hinge or cloth hinge 634. Owing to the unhingeing movement of the spring steel beam 617 at higher speeds, the air passage slots 627 are not provided in the shield 620, but in the spring steel bracket 617 itself. Consequently the air passage slots 627 in the retracted position at higher speeds, occupy the physically correct position in which a good cooling effect of the engine is achieved.

The embodiment according to Fig 7 differs from that in Fig 6 only in the construction of the beam 712. The same components are therefore once again provided with the same reference numerals referred to the number 700. In conformity with the embodiment according to Fig 3, the beam 712 forms, with the cross strut 716, a preferably integral, substantially C-shaped stirrup 730, the two short arms 731 of which are retained pivotably about the pivot axis 733 near the top edge of the protector part strap 632. In the basic position (solid lines in Fig 7) of the protector part 711 or of the front piece 714, the protector part 711 absorbs impact forces up to a maximum value e.g., 10,000 N, because the pivotability of the short arms 731 is blocked by a locking means, not shown. In the case of higher forces or static pressures above a maximum value of 10,000 N, the short arms 731 begin to twist about their fixed longitudinal axis in the manner of a torsion bar. At higher speeds the blockage of the pivotability of the stirrup 730 is cancelled — as described for Fig 6 — and the protector part 711 or the front piece 714 hinges into the aerodynamically favourable position shown by chain-dotted lines in Fig 7. Here again a shield 720 is clamped between the bottom side 719 of the bumper 710 and the cross strut 716, and is drawn round the cross strut 716 and also covers the bottom side of the stirrup 730. This shield 720 may be formed by the outer skin 715 of the protector part 711. The air passage slots 727 are arranged so that they occupy a favourable position for the engine cooling at higher speeds in the retracted position of the protector part 711 or of the front piece 714 indicated by chain-dotted lines in Fig 7.

The only difference between the embodiment according to Fig 8 and the device according to Fig 7 just described is that the shield 820 is formed by the outer skin 815 of the protector part 811, which also covers integrally the front side 829 of the bumper 810. The outer layer 815 has an elastic zone placed near the bumper bottom 819, which slides in beneath the bumper bottom 819 forming a fold (shown by chain-dotted lines in Fig 8) when the protector part 811 or the front piece 814 hinges in after the blockage of the pivotability is cancelled. Otherwise the same components are provided with the same reference numerals, which are however increased by 800.

In the embodiment according to Fig 9, the same components are again designated by the same reference numerals but increased by 900. This impact protection device differs from that described for Fig 8 only in that the protector part 911 or its front piece 914 is not pivotable, but slidable between the basic position and the retracted position. The beam 912, which again forms a C-shaped stirrup 930 together with the cross strut 916, is retained and guided slidably in the longitudinal direction of the vehicle. For this purpose the short arms 931 of the stirrup 930 engage into a longitudinal guide 935 provided near the top edge of the protector part strap 932. In the basic position (solid lines in Fig 9) of the protector part 911 or of the front piece 914, the sliding mobility of the stirrup 930 is again blocked by a corresponding locking means, not shown, which is cancelled only at higher speeds (above 60 Km/h) at which pedestrian protection is no longer conceivable. Here again, the outer layer 915 of the protector part 911 which extends across the front side 929 of the bumper 910 clamps between the stiffening element 913 or the cross strut 916 and the bottom 919 of the bumper 910, a shield 914 which contains air passage slots 927 or grille-like structure. As in the embodiments according to Figs 7 and 8, the stirrup is aligned substantially horizontally with a slight forward and upward orientation. With the stirrup 930 blocked, the protector part 911 acts as initially described in the case of a collision with a pedestrian. The torsion bar effect of the stirrup 930 at higher static pressures is also fully valid. When the locking of the stirrup is cancelled at higher speeds, the protector part 911 or the front piece 914 moves into the retracted position indicated by chain-dotted lines in Fig 9. Here again the sole purpose of the sliding mobility of the stirrup 930 is to improve the aerodynamics of the impact protection device at higher speeds at which pedestrian protection is no longer possible in any case.

In all the embodiments according to Fig 1—9, the protector part 11—911 has a front piece 14—914 covering its central region, which in contrast to the two side aprons 21 adjoining it, extends forwards and downwards at an acute angle to the vertical. The beam 12—912 and the stiffening element 13—913 in the form of a tubular cross strut 16—916 are present exclusively in this front piece 14—914.

In the embodiment according to Figs 10 and 11 the protector part 1010 is shaped identically along its entire length, so that both the central region and also the side regions adjoining it on both sides project outwards at an acute angle to the vertical. The stiffening element 1013, which here again may be constructed as a tubular cross strut 1016, extends substantially along the entire length of the protector part 1011. A plurality of — in this case two — beams 1012, which are constructed as approximately U-shaped stirrup-shaped brackets 1036 in cross section, are arranged at mutual intervals. These brackets 1036 are attached rigidly by their short arms 1037 to the longitudinally continuous cross strut 1016. The long members 1038 are attached in the manner of a torsion bar to the bottom side 1019 of the bumper 1010. The

outer layer 1015 covers the front side of the bumper 1010 integrally as far as the longitudinally continuous cross strut 1016, covers the latter and terminates in a free member pointing to the rear. Here again, the same components are designated by the same reference numerals, but increased by 1000. The section of the device shown in Fig 10 is a section along the line X—X in Fig 11. For clarity in Fig 10, the removed part of the device is shown by a dash lines.

In the embodiment according to Fig 12, the protector part 1211 likewise extends from the bumper bottom 1219 downwards, is inclined forwards at an acute angle to the vertical at least in a central region oriented substantially transversely to the vehicle longitudinal axis, and is taken sideways apron-fashion on both sides of this central region as far as the wheel arch 1240 of the vehicle 1241. The protector part 1211 likewise has the outer layer 1215 with a rind-like characteristic and, in the farthest projecting zone, a stiffening element 1213 of limited yieldingness. The stiffening element 1213 in this case is constructed as a hard foam block 1242. This hard foam block 1242 is simultaneously part of the beam 1212 which yields to a frontal force in excess of the prescribed maximum value (e.g., 10,000 N) which also has a rigid supporting part 1243. The hard foam block 1242 is arranged between the front of the supporting part 1243 and the outer layer 1215. The supporting part 1243 and the hard foam block 1242 give the beam 1212 a yielding property, so that the protector part 1211 can escape behind the front edge of the bumper 1210 at high static pressures which exceed the prescribed maximum value.

The protector part 1211 is connected to the bumper 1210 by a pivot device 1244 with parallelogram linkage indicated schematically in Fig 12. This pivot device may be realised e.g., by torsion bar springs. This pivot device 1244 permits a displacement of the protector part 1211 out of the retracted position shown by solid lines in Fig 12, into a basic position which is indicated by dash lines in Fig 12. In the retracted position the protector part 1211 is located immediately below the bumper 1210 and its front edge aligns substantially with the front edge of the bumper 1210. In the basic position, in which the protector part 1211 constitutes efficacious pedestrian protection, it is placed lower and projects forwards beyond the bumper 1210, so that it has all the advantageous properties as initially described. When, as in the above embodiments, the outer layer 1215 also covers the front surface of the bumper 1210, an elastic zone is provided in the outer layer 1215 at the transition between bumper 1210 and protector part 1211. By this means the displacement of the protector part 1211 away from the bumper 1210 downwards and forwards is made possible without a gap or a crack region being created between the bumper 1210 and the protector part 1211.

The embodiment according to Fig 13 corresponds largely to the embodiment in Fig 12 so that the same components are designated here by the same reference numerals, but increased by 1300. The displacement of the protector part 1311 occurs in this case by extensible elements 1345, which may be formed e.g., by gas springs, hydraulic valves etc. In this case a sliding of the protector part 1311 into the basic position in front of the bumper 1310 occurs parallel to the bottom side 1319 of the bumper 1310. The basic position of the protector part 1311, in which the latter is efficacious as a pedestrian protection, is also shown by dash lines in Fig 13, and the retracted position of the protector part 1311, which improves the aerodynamics and the stability of the vehicle, is shown by solid lines.

CLAIMS

1. An impact protection device for vehicles, including a bumper arranged to extend, in the installed position, transversely across the front of the vehicle with a forward-projecting substantially rigid pedestrian protector part below the bumper, wherein the protector part extends downwards from the bumper, is inclined forwards at an acute angle to the vertical at least in a central region oriented substantially transversely to the vehicle longitudinal axis, and leads round sideways apron-fashion approximately to the wheel arch of the vehicle on both sides of the vehicle.

2. A device according to Claim 1, wherein the protector part has at least in its central region, an outer layer with a rind-like characteristic and has in its outermost projecting zone a stiffening means of limited yieldingness which is longitudinally continuous at least in the central region.

3. A device according to claim 2 wherein said outer layer comprises a relatively hard polyurethane skin and the stiffening means comprises a stiffening element of plastic material.

4. A device according to claim 3 wherein the protector part has at least one beam adapted to yield to a frontal force exceeding a prescribed maximum value, which supports the stiffening element and braces the outer layer.

5. A device according to claim 4 wherein the beam is retained on the bumper or on a bumper bracket.

6. A device according to claim 4 or 5 wherein the stiffening element is constructed as a tubular cross strut.

7. A device according to claim 6 wherein the stiffening element is a hollow profile tube of fibre-reinforced plastic or thin-walled metal tube.

8. A device according to claim 4, 5, 6 or 7 wherein the beam is constructed in cross section as a leaf-spring-like spring steel bracket which is attached adjacent one edge to the bumper bottom and supports the cross strut on its other free edge.

9. A device according to claim 6, 7 or 8 wherein the cross strut and the beam form a substantially C-shaped stirrup the two arms of which engage the bumper in the manner of a torsion bar.

10. A device according to claim 9 wherein the cross strut and the beam are integral to form said stirrup, the arms thereof being rigidly anchored to

the torsion bar.

11. A device according to any one of claims 4 to 10, wherein the beam has a substantially rigid supporting part and a hard foam block arranged between the supporting part and said outer layer.

12. A device according to any one of claims 2 to 11 wherein the outer layer extends past the entire front surface of the bumper and completely covers the latter.

13. A device according to claim 12 wherein the outer layer is arranged on the front side of the beam.

14. A device according to any one of claims 1 to 13, wherein the protector part has a front piece projecting spoiler-fashion and covering the central region, and side aprons adjoining it on both sides, which align substantially with the front surface of the bumper.

15. A device according to claim 14 wherein said side aprons are secured to the bumper.

16. A device according to claim 14 or 15 wherein the front piece and the side aprons are mutually connected by side wall parts.

17. A device according to claim 16 wherein the front piece the side aprons and the side wall parts are mutually integral and the side wall parts have preshaped folds.

18. A device according to claim 16 wherein the front piece and the side wall parts are mutually integral and the latter overlap the side aprons on their rear side facing the vehicle.

19. A device according to any one of claims 14 to 18 wherein the beam with cross strut is arranged in the front piece of the protector part.

20. A device according to any one of claims 14 to 19 wherein the front piece has a plurality of air passage slots.

21. A device according to any one of claims 1 to 20 wherein at least the front part of the protector part is movable selectively into two positions, the protector part or its front piece in its basic position, projecting beyond the bumper in the longitudinal direction of the vehicle, and in its retracted position being behind the bumper.

22. A device according to claim 21 wherein at least the front part of the protector part is aligned with the front side of the bumper when in the retracted position.

23. A device according to claim 21 or 22 wherein the protector part or its front piece is lockable in its basic position.

24. A device according to claim 21, 22 or 23 wherein the beam is arranged to be pivotable about a pivot axis oriented transversely to the vehicle longitudinal axis or is retained slidably in the longitudinal direction of the vehicle.

25. A device according to claim 24 wherein in the basic position of the front piece the beam extends forwards with a substantially horizontal orientation and is guided slidably on or articulated by one end to a protector part strap connecting the two apron parts beneath the front piece.

26. A device according to claim 25 wherein the beam extends forwardly with a slightly upwardly directed orientation.

27. A device according to claim 25 or 26 wherein a shield is clamped between the bumper bottom and the front end of the beam.

28. A device according to claim 27 wherein the shield is formed by said outer layer of the protection part.

29. A device according to any of claims 12 to 28 wherein an elastic zone is provided in the outer layer near the bumper bottom.

30. A device according to claim 21 or 29 wherein the protector part is connected to the bumper by a pivot device and/or a parallel guide which is constructed so that the protector part is displaceable from its retracted position farther forwards and downwards away from the bumper bottom into its basic position.

31. An impact protection device for a motor vehicle substantially as described herein with reference to and as illustrated in Figures 1, 2 and 4, or Figure 1, 2 and 4 as modified by Figure 3 or any one of Figures 5 to 13 of the accompanying drawings.

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